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Oak Ridge National Laboratory

Health Physics Division

APPLIED HEALTH PHYSICS ANNUAL REPORT

January - December 1957

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SECTION I. AREA MONITORING

Part A. Salient and Non-Routine Items

Radiation Hazards Training Assistance

Preliminary tests were conducted to determine the suitability of Br^{82} and Y^{90} solutions for demonstrating radioactive contamination problems. The isotopes used as possible contaminating agents were selected from a theoretical treatment by T. J. Burnett. The solutions were being investigated at the request of Mr. F. L. Brannigan, Safety and Fire Protection Branch, AEC, Washington, D. C. Mr. Brannigan planned to use the solutions in a radiation hazards training program for public protection groups, demonstrating the problems of radioactive contamination associated with atomic attack and fires or other emergencies involving radioactive materials.

Squares of blotter paper were contaminated with each test solution and with a mixture of the solutions. The contamination was accomplished by pipetting aliquots of the solution into small beakers and then spreading the solution evenly on the squares of blotter paper with a camel hair brush. Measurements of the radiation intensity being emitted from each square were made at several distances from the squares with different types of radiation survey instruments to determine the suitability of the solutions for the test, the type of instrument best suited to training, and the most desirable levels of contamination to be used.

It was concluded that the solutions were suitable for such a program of training. Contamination levels of approximately 50 μc/sq. ft. of surface was found to give adequate radiation levels for training purposes without subjecting the trainees to exposures in excess of maximum permissible limits. The instrument most suited to such a training program using this level of contamination appeared to be the GM Survey Meter.

Mr. Brannigan has conducted several training programs to date in various cities throughout the U. S. using the solutions recommended and tested in this study.

Natural Radioactive Elements in TVA Lakes

The study of the amounts of natural radioactive elements in TVA lake samples continued during this period. All of the samples collected were analyzed for uranium, thorium, and potassium. Analysis for radium required the samples to be sent elsewhere. This work is being done at the New Brunswick Area Office of the AEC. Results of analyses to date are being tabulated for study.

Air Contamination Study at Waste Pits

A network of ten sampling stations were activated in the Waste Pit area in an attempt to determine if there existed air contamination associated with operation of the waste pit disposal facility. Air samples were collected by means of an automatic air sampler manufactured by Research Appliance Corporation. Fallout samples were collected by the gummed paper technique. Air samples were counted for gross beta activity. Fallout samples were examined for radioactive particles by autoradiography and for total beta activity by dry ashing and counting. Results were tabulated and examined for statistical significance with reference to samples from the Laboratory and perimeter areas by D. A. Gardiner of the Mathematics Panel. After a preliminary examination of the data, it was decided to use only the data from the ashed gummed papers in the complete statistical analysis.

The conclusion of the analysis was that there existed a significant difference in the activity among areas, and that the mean of the pit area was greater than either the Laboratory or the perimeter area. These were significantly different at the 1 per cent level. In addition, there was a highly significant difference among the stations in the pit area.

Particle Fallout From 3019 Process

Autoradiograms of gummed paper fallout trays for the week ending October 7, 1957 revealed a high incidence of fallout on the Laboratory of significantly more active particles than are normally experienced. Analysis of the activity by gamma spectrometry indicated the majority of the activity to be Pa^{233}. This situation returned to normal the following week.

The high activity occurred again during the week ending October 27 and persisted for the remainder of the year, diminishing slowly after the separations process was discontinued. Eighteen special fallout trays were placed in the field to follow the change in particle activity. The stations were placed at approximate 100 yard intervals radiating from the 3020 stack in north, east, south, and west directions and changed at daily intervals.

A study was undertaken to determine more accurately the source, size, and nature of the particulates. Particles taken from a gummed paper fallout tray near the base of the 3020 stack were compared with particles collected in an air sample from the cell ventilation duct from Building 3019. Particles were analyzed by optical microscopy, gamma ray spectrometry, spectroscopy, and X-ray diffraction. Photographs of the nature of the surface of the particles are given in Figure 1.

CV-3019

CV-3019

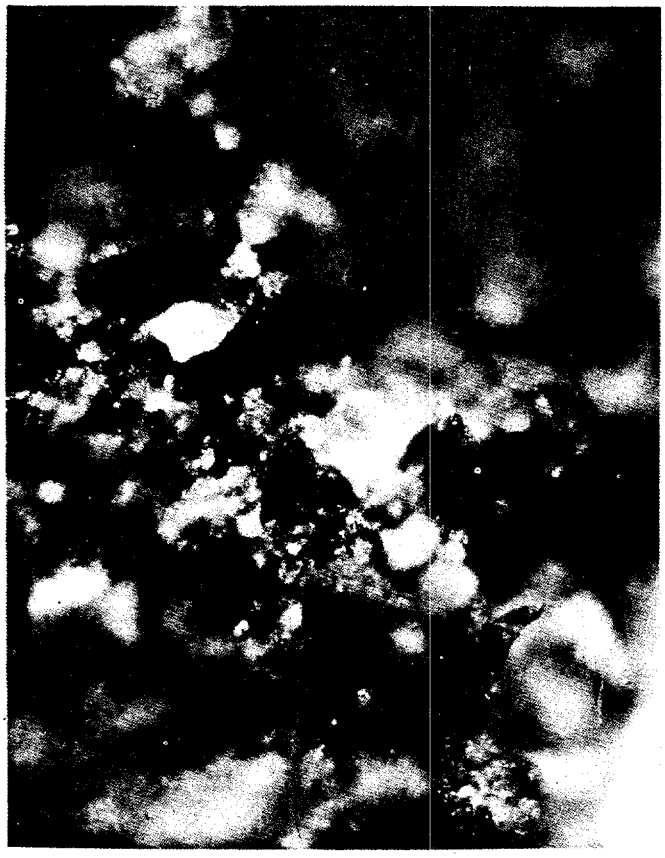

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Figure 1

The findings indicated the activity to be predominately Pa^{233} affixed to Fe_2O_3 particles or rust particles in both the fallout sample and the cell ventilation sample. It was apparent that the cell ventilation duct was the predominant source of the activity.

The process has been discontinued and replacement of the rusty cell ventilation duct and installation of a particulate filter system for the 3020 stack is in progress.

Since a complete size analysis of the radioactive particulates in the atmosphere was not practicable, it was decided to try to determine if the radioparticulates were respirable. For this purpose, a sampler was selected that separates the collected dust into two fractions, corresponding approximately to the fractions that would be removed by the upper and lower respiratory system of man. A report of the results will be issued sometime in the near future.

Air Monitoring Modification

A modification was made to the present telemetering system for the local continuous air monitors. An alarm system was developed and installed at the central control station and a slave alarm unit installed in patrol headquarters. If a continuous air monitor collects sufficient activity on the filter to subject the sensor unit to a level of 10,000 c/m, a buzzer will sound and a red light will be in evidence at both the central and slave stations. The buzzer will continue to sound until the acknowledge button is pushed or the telemetering circuit switches to a different station. Thereafter, each time the circuit switches back to the station with the filter reading in excess of 10,000 c/m the process will be repeated.

During the regular day shift, the slave station at patrol headquarters can be disconnected from the system by actuating an 8 hour timer each morning. At the end of 8 hours, the slave station will be switched automatically into the system again. This assures that on nights, weekends, and holidays, the station will be attended at all times by someone and, should high air activity occur, the proper Health Physics personnel can be notified.

Radionuclides in River Bottom Sediment

The laboratory work and the analysis of the data from the 1954, 1955, and 1956 surveys of the Clinch and Tennessee Rivers has been completed and the final report has been written. The report is now being edited for publication.

Average radioactive particulate concentration measured by continuous air monitors increased in all areas by approximately a factor of two over the average concentration of last year. The increase was primarily the result of fallout from weapons tests during the year. However, one of the Laboratory processes contributed substantially to the high particulate activity experience on the Laboratory, particularly particles of higher activity than are normally experienced. Figure 2 is a plot of the weekly average particle count, expressed in particles per 1000 ft^3 of air sampled, on the Laboratory area, in the perimeter area, and at the remote station at Berea, Kentucky.

The results of fallout measurements made by gummed paper fallout trays are plotted in Figures 3 and 4. The high activity pictured during the last half of the year in both particles/ft^2 and $\mu c/ft^2$ was predominantly due to fallout from continental weapons tests in the case of the perimeter stations. Laboratory processes accounted for most of the high activity on the Laboratory area during the last quarter of the year.

Figure 5 is a plot of the rainout experienced in Laboratory, perimeter, and remote areas. Here again the high concentrations of radioactivity detected may be attributed to weapons tests.

The weekly average concentration of radioactive contamination in the Clinch River is given in Figure 6. The operating limit of 10^{-7} $\mu c/cc$ gross beta activity in the Clinch River was exceeded 28% of the time during the year, Figure 7. The total gross beta curies discharged from White Oak Creek to the Clinch River was 32% less than the total discharged during last year. The weekly average gross beta concentration in the Clinch River for the year was $.86 \times 10^{-7}$ $\mu c/cc$. Figure 8 is a plot of the per cent MPC_w which occurred each week. These data are based on radiochemical analysis for the long lived fission product contaminants. It should be noted that the MPC_w was not exceeded at any time during the year.

A routine program of determining the fission product contamination in the water of the Clinch River at a point downstream where it becomes available to large population users was started at the beginning of this year. A daily grab sample of approximately a quart is taken from the river at Center's Ferry near Kingston, Tennessee, and composited into a quarterly sample. The composite sample, approximately 20 gallons, is filtered to remove the suspended solids. The filtrate is concentrated by evaporation to a volume of about 1 gallon and the concentrate analyzed for fission products The suspended solids are weighed and analyzed for fission products. Table I gives the results of these analyses for the first three quarters of the program. More pressing work prevented the completion of the analysis of the fourth quarter sample in time for this report.

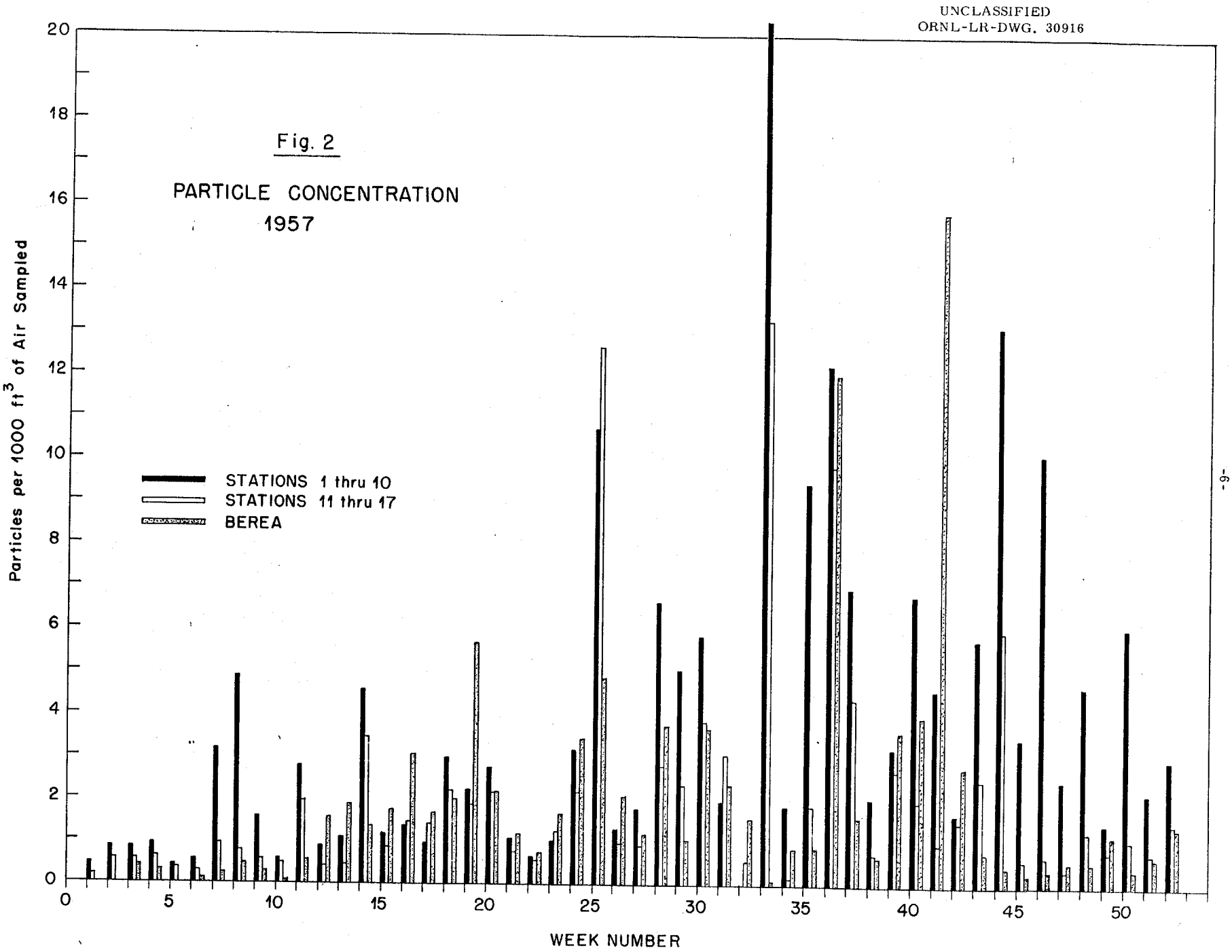
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Fig. 2
PARTICLE CONCENTRATION
1957
STATIONS 1 thru 10
STATIONS 11 thru 17
BEREA
Particles per 1000 ft3 of Air Sampled
WEEK NUMBER
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
45
50

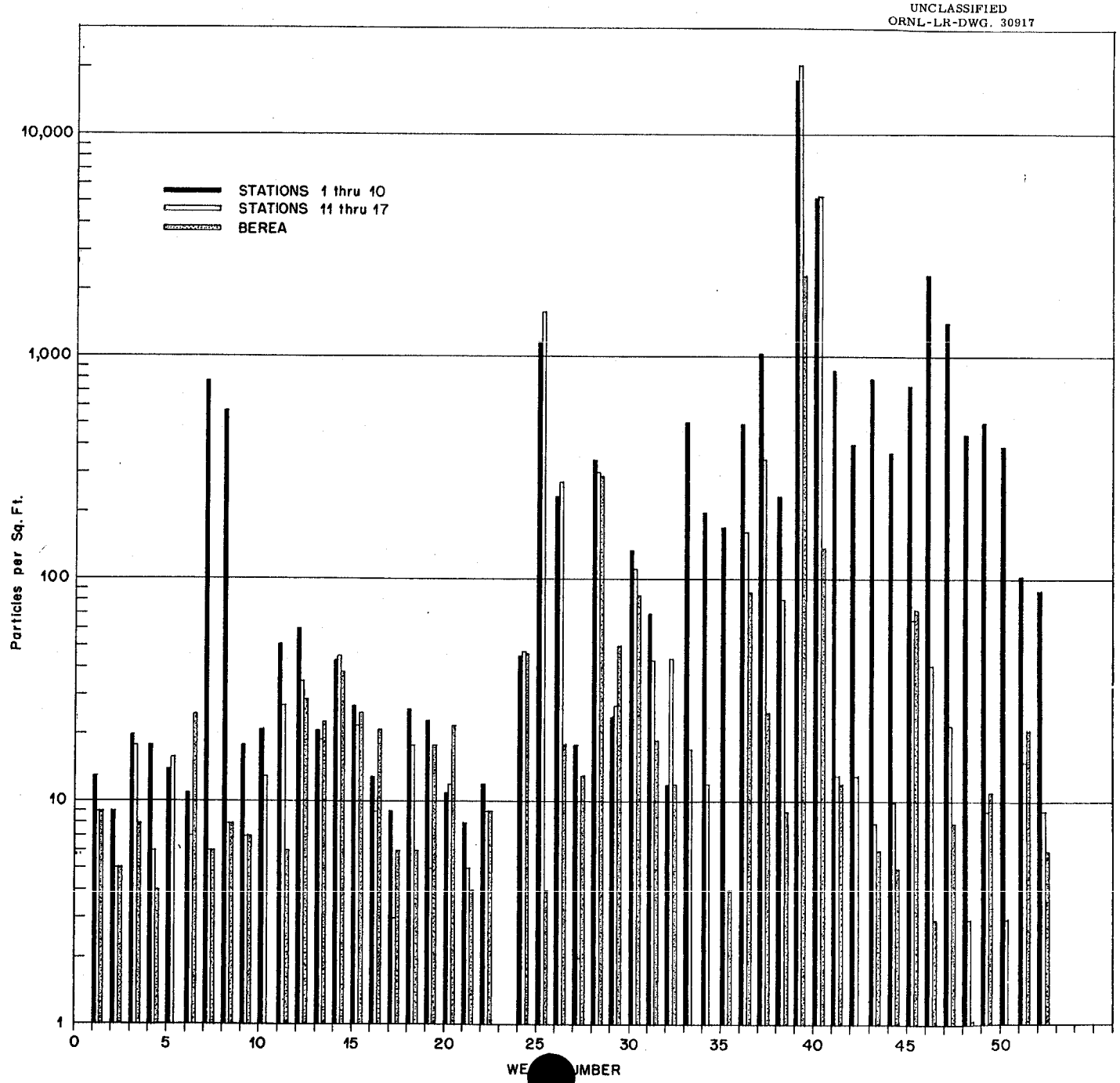

Fig. 3 — PARTICLE FALL-OUT, 1957

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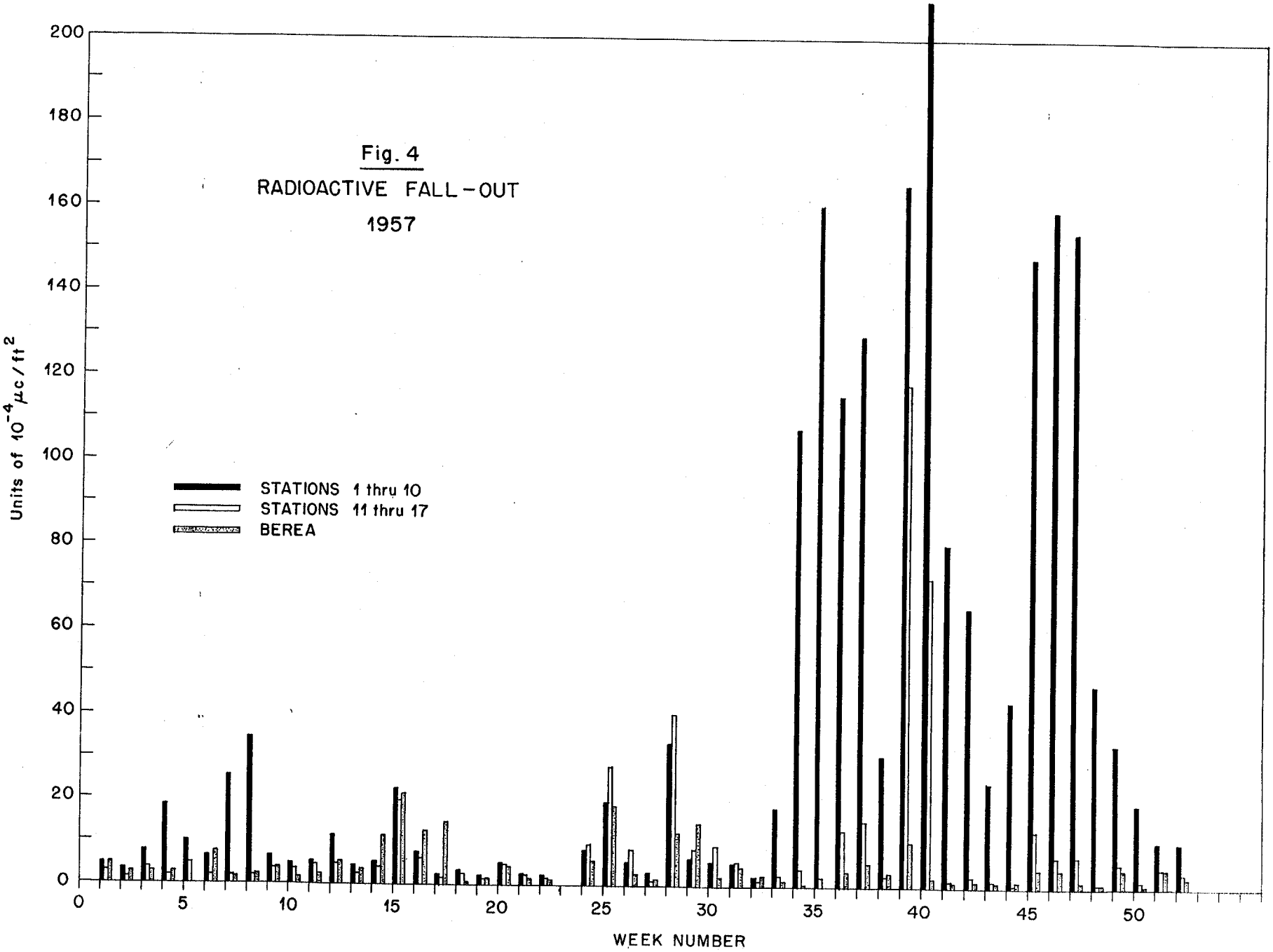
Fig. 4
RADIOACTIVE FALL-OUT
1957



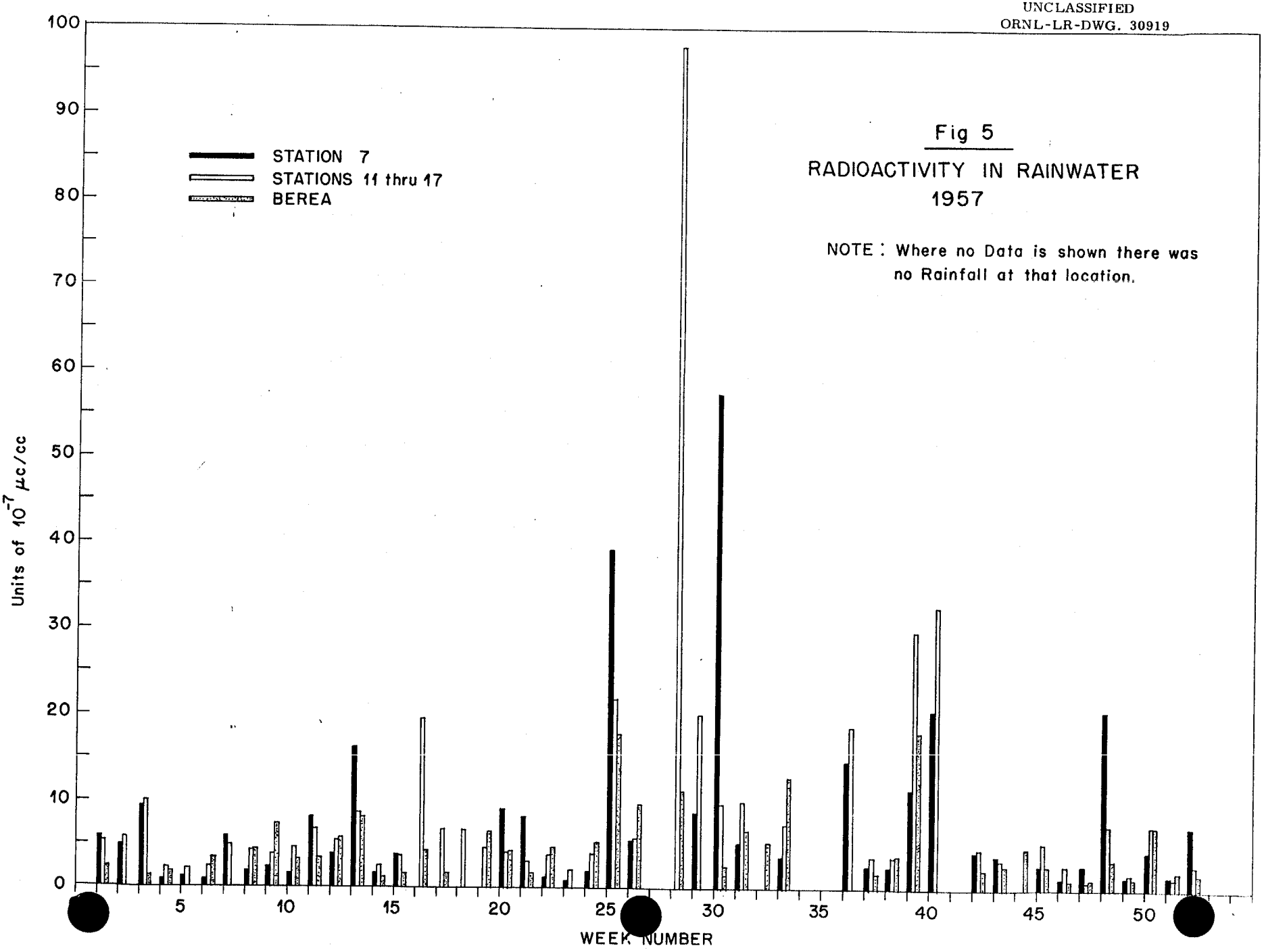


Fig 5

RADIOACTIVITY IN RAINWATER
1957

NOTE : Where no Data is shown there was no Rainfall at that location.

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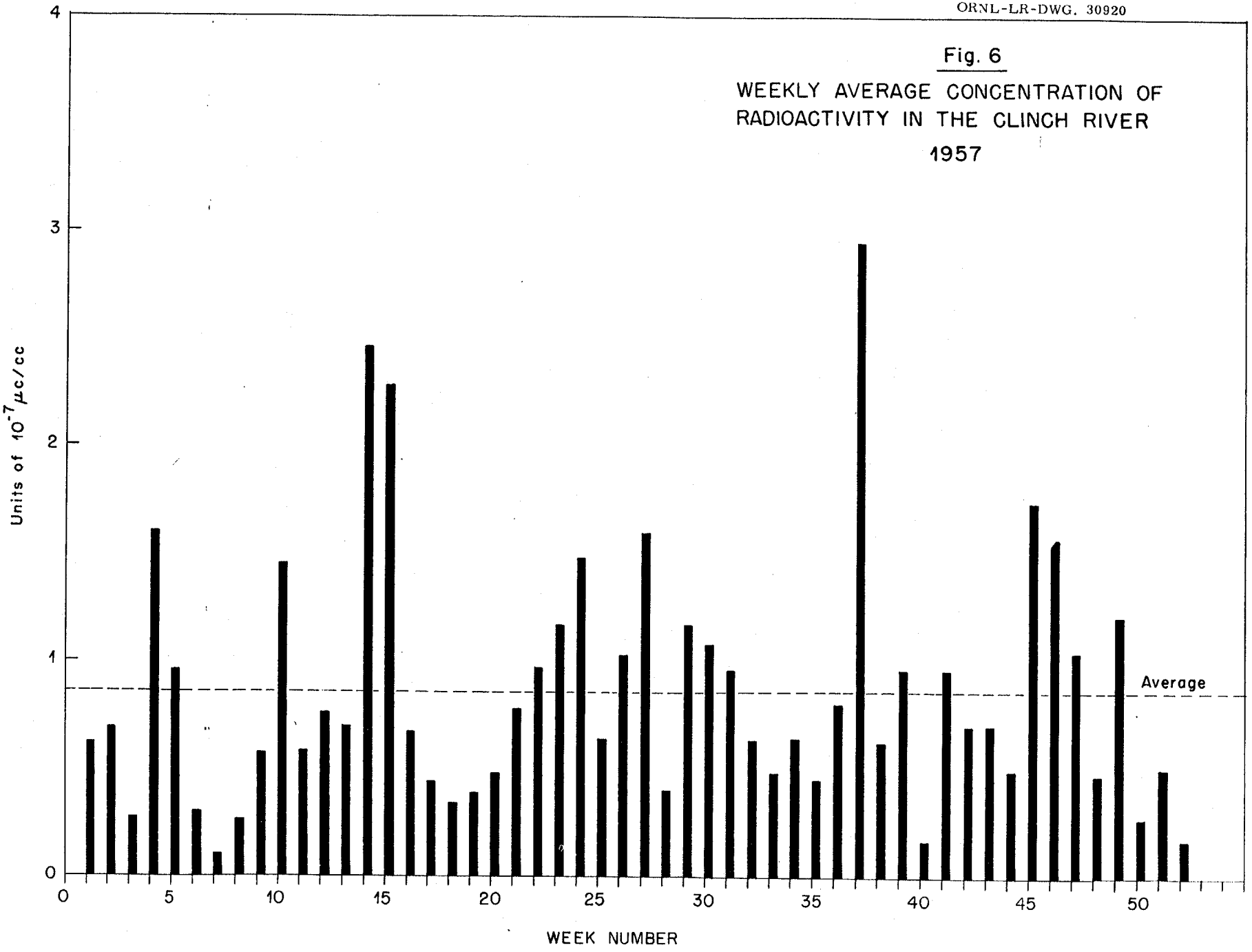
Fig. 6

WEEKLY AVERAGE CONCENTRATION OF RADIOACTIVITY IN THE CLINCH RIVER

1957



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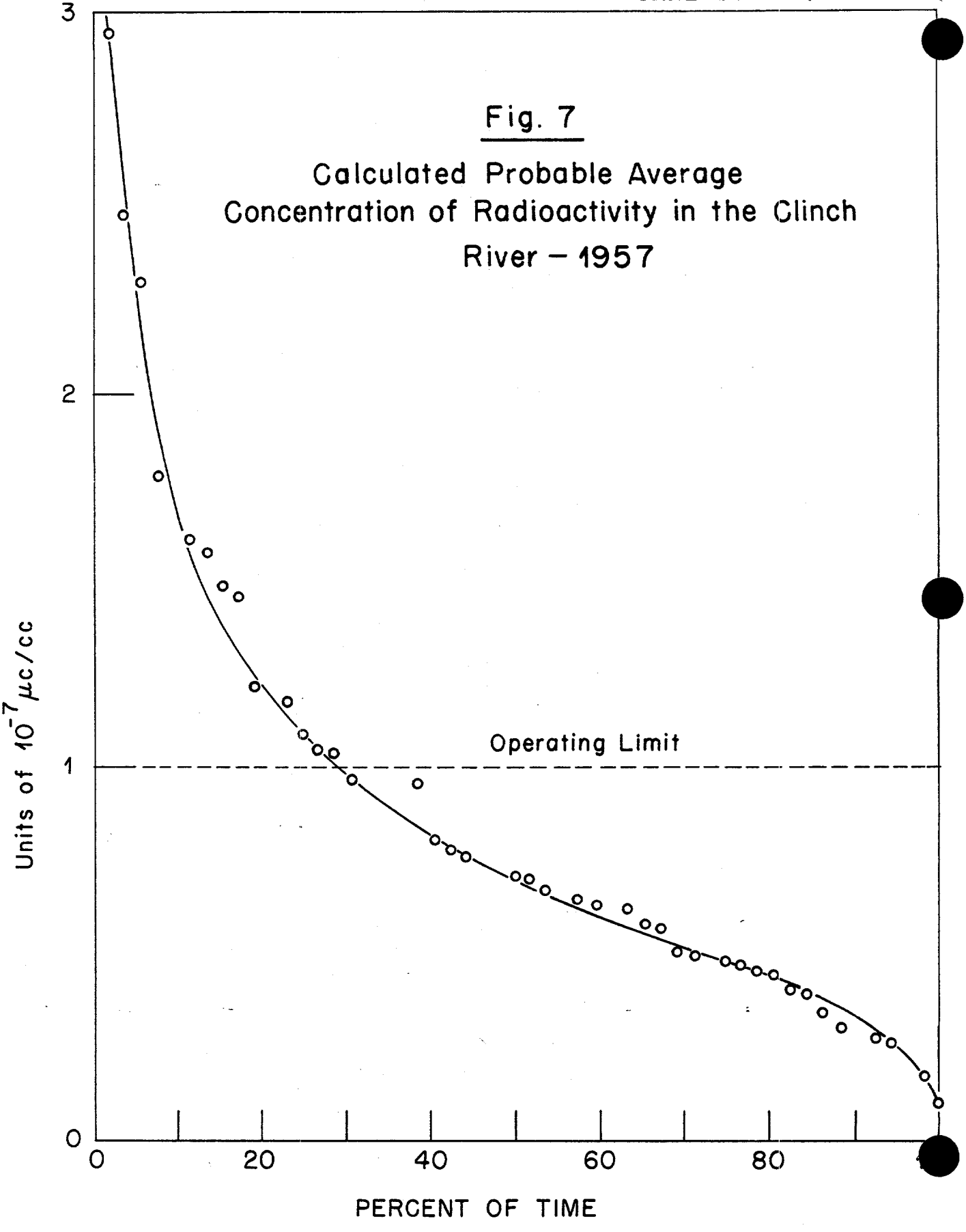

Fig. 7

Calculated Probable Average Concentration of Radioactivity in the Clinch River – 1957

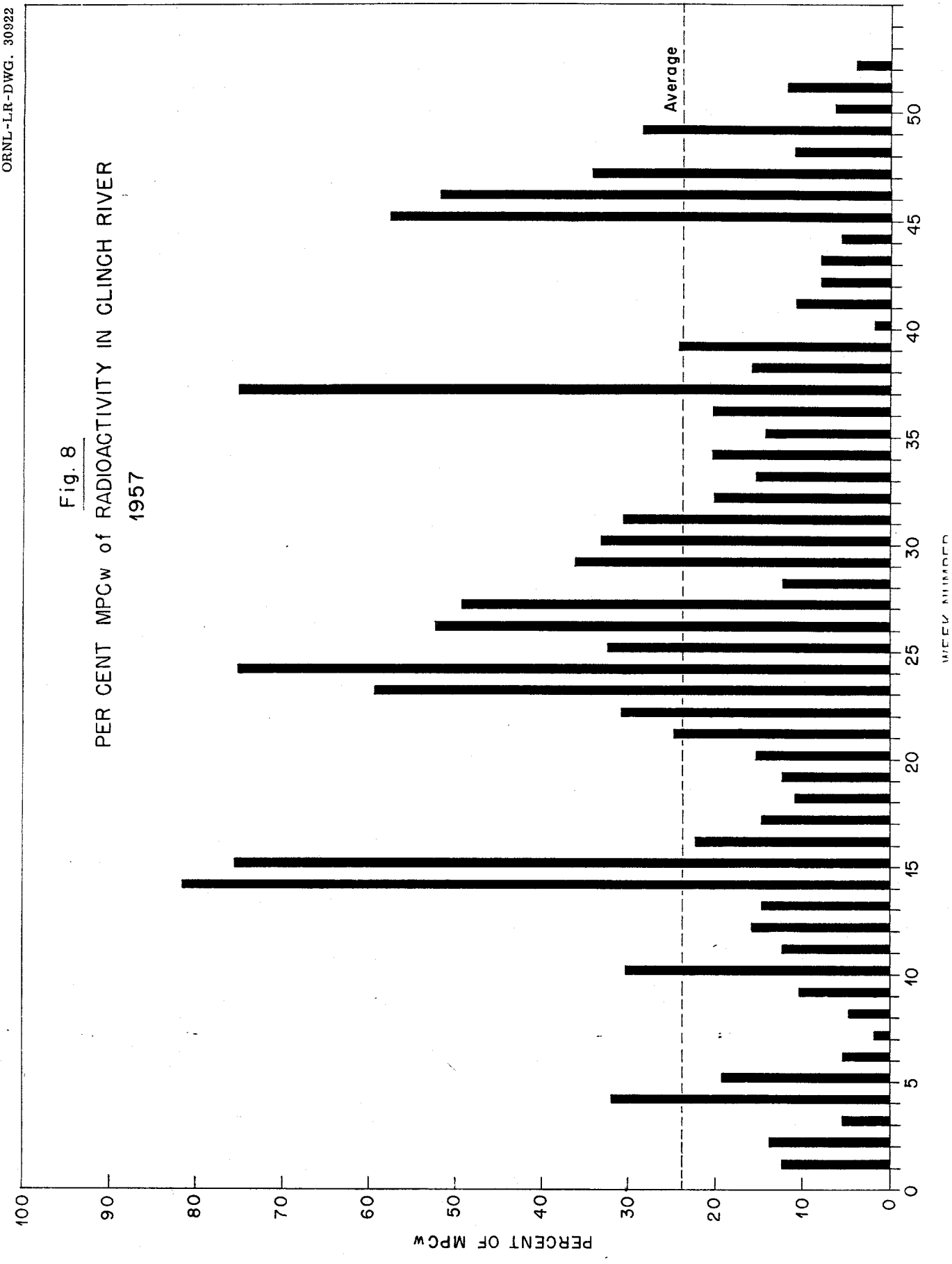
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Fig. 8
PER CENT MPCw of RADIOACTIVITY IN CLINCH RIVER
1957
Average
PERCENT OF MPCw
WEEK NUMBER
0
10
20
30
40
50
60
70
80
90
100
5
15
25
35
45

TABLE I

	Sr-90 * d/m/ml		Ce-144** d/m/ml		Cs-137** d/m/ml		Ru-106** d/m/ml		Zn-Nb-90** d/m/ml		Co-60** d/m/ml	
	LIQUID	SOLIDS	LIQUID	SOLIDS	LIQUID	SOLIDS	LIQUID	SOLIDS	LIQUID	SOLIDS	LIQUID	SOLIDS
Quarter Ending 1-25-57	~0.04	< 0.02	< 0.02	<0.008	~0.015	~0.028	~ 0.03	<0.006	<0.006	~0.002	< 0.02	~0.004
Quarter Ending 4-30-57	~0.03	<0.002	< 0.01	<0.004	~0.007	~0.03	< 0.02	<0.004	<0.004	<0.002	~0.003	~0.003
Quarter Ending 8-11-57	~0.06	<0.002	< 0.02	<0.01	~0.008	~0.007	< 0.04	< 0.01	--	--	<0.01	~0.002

* Analysis by Radiochemical Methods.

**Analysis by Gamma Spectrometry.

On the basis of results of the 1954-55-56 surveys, the 1957 survey was extended downstream to TRM 354.4, a distance of ~220 miles below the outfall of the radioactive contaminants from the Laboratory. As in previous surveys gamma measurements were made on the surface of the bottom sediment and samples of the sediment were collected and brought to the Laboratory for analysis. When the laboratory work has been completed the results of this survey will be published in the Applied Health Physics Annual Report.

Personnel

One member of the Area Monitoring Section was transferred to Radiation Survey Section in May of this year which reduced the staff of the section by 10%. A temporary summer employee was hired to assist in the river survey program. The temporary employee returned to school in September after the field work for the river program was completed.

In July members of the section assisted the Waste Disposal Research Section in conducting a study of the behaviour of radioactive contamination in the Clinch River under constant flow conditions.

Discussion of Routine Data

Air contamination data for the Laboratory area are based on samples collected by ten continuous air monitors located throughout the area. Perimeter area data are based on samples collected by continuous air samplers located at the AEC guard portals which roughly encircle the area. The weekly average value of air contamination in the Laboratory area for the year was 8.2×10^{-12} μc/cc. The highest average air contamination recorded by a given air monitor in the Laboratory area for a single week was 5.6×10^{-10} μc/cc. The highest single incident of air contamination was experienced on September 12, 1957. A sample collected for five hours on that day gave an average contamination level of 1.7×10^{-8} μc/cc which was in excess of the operating maximum permissible value for beta gamma activity of 1×10^{-8} μc/cc. This air activity resulted from faulty scrubber operation in the 3019 hot pilot plant off gas system. The activity was primarily radioactive iodine and the high level persisted for only a short time.

The average air contamination in the perimeter area for the year was 1.5×10^{-12} μc/cc. This is approximately a factor of 5 less than that experienced in the Laboratory area. The average air contamination measured at our remote sampling station at Berea, Kentucky was $.9 \times 10^{-12}$ μc/cc, indicating that the majority of the activity detected at our perimeter stations and some of the Laboratory area contamination was the result of weapons test fallout.

Area background measurements were made and reported on a monthly basis. The average background in the Laboratory for the year based on these measurements was .1 mr/hr. The average background measured in the perimeter area was .02 mr/hr.

The Laundry Monitoring Unit checked 215,502 garments for contamination during the year. A total of 18,383 of the garments checked were found to be above maximum permissible limits. In addition to the garments, a total of 248,196 special items such as towels, shoe covers, gloves, caps, etc., were monitored for contamination. A new instrument for monitoring contaminated clothing for beta-gamma activity was installed for testing during the period. Basically, the instrument is a modified Quintector with four GM tubes paralleled into each rate meter circuit. Only two of the five rate meter circuits are currently in use. The instrument calibrates well and permits clothing to be checked at a more rapid rate at the "R" clothing tolerance level. If the instrument proves to be sufficiently rugged for long term use, it will be adopted as the beta-gamma laundry monitor.

Part B. Statistical Data

1. Air Contamination Studies

a. Constant Air Monitors

(1) Air Activity - μc/cc

(a) Laboratory Area

Station Number	Location	Maximum Conc. x 10^{-13} μc/cc	Average Long Lived Activity: Weekly Av. this year Conc. x 10^{-13} μc/cc	Deviation from 1956 Weekly Av.
HP-1	N 3550	1150.03	93.08	+163.2%
HP-2	S 3001	1167.05	64.78	+250.7%
HP-3	S 1000	453.20	64.83	+206.2%
HP-4	W 3513	928.41	80.12	+225.3%
HP-5	E 3506	749.56	168.59	+ 70.8%
HP-6	SE 3012	999.98	55.28	+300.0%
HP-7	W 7001	546.77	38.14	+170.7%
HP-8	Rock Quarry	146.68	25.24	+170.7%
HP-9	A-10 Site	5607.00	141.43	+833.5%
HP-10	E 2074	2022.55	91.31	+221.9%
Average			82.32	
Deviation of this year's average long lived activity from last year's average				+194.8%

Part B. Statistical Data (Cont'd)

1. Air Contamination Studies

a. Constant Air Monitors

(1) Air Activity - μc/cc

(b) Perimeter Area

Average Long Lived Activity

Station Number	Location	Maximum Conc. x 10^{-13} μc/cc	Weekly Av. this year Conc. x 10^{-13} μc/cc	Deviation from 1956 Weekly Av.
HP-11	Kerr Hollow Gate	229.72	17.17	+104.2%
HP-12	Mid-way Gate	87.70	12.33	+149.1%
HP-13	Gallaher Gate	99.26	15.64	+146.3%
HP-14	White Wing Gate	76.22	12.28	+ 87.5%
HP-15	Blair Gate	109.94	15.96	+121.1%
HP-16	Turnpike Gate	123.26	14.76	+117.7%
HP-17	Hickory Creek Bend	96.43	15.26	+ 79.5%
Average			14.77	
Deviation of this year's average long lived activity from last year's average				+111.9%

(c) Remote Area

B	Berea, Ky.	45.91	9.03	- 11.1%

Part B. Statistical Data (Cont'd)

2. Particle Concentration

a. Laboratory Area

Station Number	Location	Particle Distribution - Wkly. Average Number of Particles *Activity Ranges - Dis/24 hours $<10^5$	10^5-10^6	10^6-10^7	$>10^7$	Total	Maximum this year Particles Per 1000 cu. ft.	Weekly Average this Yr. Particles Per 1000 cu. ft.	Deviation of Wkly. Average this Yr. from Wkl. Av. Last Year
HP-1	N 3550	160.27	3.80	1.24	0.06	165.37	37.55	4.29	+ 45.9%
HP-2	S 3001	161.84	4.82	1.64	0.26	168.56	21.45	3.36	+ 94.2%
HP-3	S 1000	132.53	4.62	1.78	0.31	139.14	28.75	2.83	+108.1%
HP-4	W 3513	215.42	3.08	1.87	0.29	220.66	54.89	6.26	+281.7%
HP-5	E 2506	273.88	5.41	2.37	0.24	281.90	47.45	5.21	- 10.9%
HP-6	SE 3012	153.03	4.31	0.94	0.33	159.63	14.47	3.12	+176.1%
HP-7	W 7001	151.29	2.14	0.33	0.10	153.86	20.63	3.55	+203.4%
HP-8	Rock Quarry	125.73	1.92	0.37	0.06	128.08	22.04	2.86	+214.3%
HP-9	A-10 Site	150.06	2.53	0.66	0.14	153.39	35.67	4.02	+187.1%
HP-10	E 2074	219.96	3.63	1.21	0.08	224.88	48.84	6.14	+ 85.5%
Average								4.16	
Deviation of this year's weekly average from weekly average last year									+ [redacted]

b. Perimeter Area

HP-11	Kerr Hollow	85.48	1.63	0.29	0.10	88.50	14.90	1.78	+131.2%
HP-12	Midway Gate	77.23	1.27	0.19	0.04	78.73	12.28	1.63	+219.6%
HP-13	Gallaher Gate	98.94	1.62	0.19	0.10	100.85	20.16	2.02	+260.7%
HP-14	White Wing	88.79	0.90	0.17	0.02	89.88	14.62	1.80	+221.4%
HP-15	Blair Gate	107.02	1.48	0.15	0.04	108.69	13.10	2.17	+287.5%
HP-16	Turnpike Gate	117.33	1.15	0.06	0.04	118.58	16.25	2.38	+230.6%
HP-17	Hickory Creek Bend	120.00	1.00	0.17	0.04	121.21	12.30	2.43	+145.5%
Average								2.03	
Deviation of this year's weekly average from weekly average last year									+170.7%

c. Remote Area

B	Berea, Ky.	96.76	0.27	0.00	0.00	97.03	15.81	1.90	+128.9%

2. Fallout Studies

a. Gum Paper Fallout Trays

(1) Particles

(a) Laboratory Area

Particle Distribution - Weekly Average Number of Particles

Station Number	Location	*Activity Ranges - Dis/24 Hours $<10^5$	10^5-10^6	10^6-10^7	$>10^7$	Particles Per Sq. Ft. Weekly Av.
HP-1	N 3550	1743.23	7.21	7.77	2.00	760.21
HP-2	S 3001	1059.79	12.31	13.42	4.90	1090.42
HP-3	S 1000	495.71	4.77	4.54	0.56	505.58
HP-4	W 3513	720.70	5.87	3.72	0.41	730.70
HP-5	E 2506	942.96	6.13	5.34	1.13	955.58
HP-6	SE 3012	923.81	12.81	11.71	2.85	951.17
HP-7	W 7001	512.13	2.79	1.50	0.13	516.55
HP-8	Rock Quarry	473.88	1.19	0.40	0.04	475.51
HP-9	A-10 Site	602.98	4.63	3.65	0.52	611.78
HP-10	E 2074	722.52	8.63	9.77	2.44	743.36
Average						734.09

(b) Perimeter Area

HP-11	Kerr Hollow	671.11	1.48	0.67	0.00	673.26
HP-12	Midway Gate	577.61	1.52	0.52	0.08	599.73
HP-13	Gallaher Gate	604.06	1.46	0.94	0.02	606.48
HP-14	White Wing	500.13	1.17	0.65	0.11	501.95
HP-15	Blair Gate	512.73	1.40	0.81	0.13	515.07
HP-16	Turnpike Gate	613.27	1.22	0.59	0.10	615.18
HP-17	Hickory Creek Bend	433.48	1.46	0.52	0.06	435.52
Average						563.88

(c) Remote Area

B	Berea, Ky.	66.58	1.71	0.81	0.07	69.17

2. Fallout Studies

(2) Total Activity ($\mu c/ft^2$)

(a) Laboratory Area

Station Number	Location	$\mu c/ft^2$
HP-1	N 3550	67.28
HP-2	S 3001	75.08
HP-3	S 1000	27.42
HP-4	W 3513	32.65
HP-5	E 2506	51.28
HP-6	SE 3012	44.47
HP-7	W 7001	11.93
HP-8	Rock Quarry	7.53
HP-9	A-10 Site	30.68
HP-10	E 2074	56.87
Average		40.52

(b) Perimeter Area

HP-11	Kerr Hollow Gate	7.98
HP-12	Midway Gate	9.84
HP-13	Gallaher Gate	8.82
HP-14	White Wing Gate	8.77
HP-15	Blair Gate	10.85
HP-16	Turnpike Gate	9.58
HP-17	Hickory Creek Bend	8.43
Average		9.18

(c) Remote Area

B	Berea, Ky.	4.68

3. Rain Out Studies

a. Laboratory Area

Station Number	Location	$\mu c/cc \times 10^{-7}$
HP-7	W 7001	7.62

b. Perimeter Area

HP-11	Kerr Hollow Gate	8.75
HP-12	Midway Gate	7.44
HP-13	Gallaher Gate	8.36
HP-14	White Wing Gate	5.88
HP-15	Blair Gate	11.58
HP-16	Turnpike Gate	8.01
HP-17	Hickory Creek Bend	7.32
Average		8.10

c. Remote Area

B	Berea, Ky.	4.52

4. Liquid Waste

a. Gross Beta Curies Discharged

	Settling Basin	White Oak Creek
Wkly. Av. this year	3.56	7.63
Deviation from last year's weekly av.	-27.2%	-31.9%

b. Submersion Data

	Settling Basin			White Oak Creek		
	Beta mrep/hr	Gamma mr/hr	Total mr(ep)hr	Beta mrep/hr	Gamma mr/hr	Total mr(ep)hr
Weekly Av. this year	0.217	0.172	0.389	0.025	0.019	0.044
Deviation from last year's wkly. av.	-29.5%	-35.0%	-32.1%	-40.5%	-44.1%	-40.8%

c. Plutonium Discharged

	Settling Basin		White Oak Creek	
	Conc. x 10^{-9} µg/cc	Total mg Plutonium	Conc. x 10^{-9} µg/cc	Total mg Plutonium
Weekly Average this year	1551.5	28.080	197.2	45.308
Deviation from last year's weekly Average	-50.0%	-74.6%	-55.3%	-48.8%

d. Probable average concentration in Clinch River below White Oak Creek using as a dilution factor the ratio of White Oak Lake discharge to the flow to Clinch River.

Weekly Average This Year	0.86×10^{-7} µc/cc
Deviation from last year's weekly average	-42.7%

5. Meteorlogical Data

a. Rainfall

Total this year	64.32
Normal yearly rainfall	52.38
Deviation from normal seasonal rainfall	+22.8%

6. Laundry Decontamination Measurements

	Weekly Average This Year	Deviation of this Year's Weekly Av. From Last Year
a. Garments	4387	+ 7.4%
b. Special Items	4773	+ 50.1%

SECTION II. ASSAYS-INSTRUMENTS

Part A. Salient and Non-Routine Items

A preliminary report was prepared entitled "A Current Review of Body Fluid Analysis Procedures and Method of Reporting".

The filing system for individual Bio-Assay sample date covering work done from 1950 through 1957 was completed.

Part B. Statistical Data

1. Assays and Measurements Unit (Weekly Average)

a. Counting Services

Type of Sample and Requestor	Calculations and/or Curves Plotted	No. of operations Performed Alpha	Beta	Gamma	Time Units Per Operation*	Total Units Weekly
Smears (Applied Health Physics)		5498	5331		1	10,829
Air Samples (Applied H.P.)	430	536	496		3	4,386
Area Monitoring		18.2	390		4	1,633
Sanitary Engineering			88.1		4	352
Applied Radiobiology		17.1	20.1	15.0+0	4	208
Decay & Absorption Studies (AHP)	48.9	3.8	89.2	1.1	4	704
ERDL		0.6	5.5	4.6	4	43
Thyroid Counts				2.0	10	20
Nasal Smears			110		4	440
Neutron Threshold Foil Counts				5.3	4	20
Background Standards		All Counters				3,600

Part B. Statistical Data

1. Assays and Measurements Unit (Weekly Average)

a. Counting Services (Cont'd)

*One time unit equals 2/3 minute or actual operating time requiring constant attendance by technician. (Average technician's time to make and record a one minute count attending six counters).

Average Units Per week this Report	11,118
Deviation of Weekly Average this Report from 1956 Weekly Average	+ 41.3%
Total Units Handled to Date this Year	578,110

b. Bio-Assay Sampling Data

Type of Analysis	Total Samples 1957	1958	Weekly Av. 1957	1956	Deviation from 1956 Av.
Pu	653	728	12.6	14.1	- 11%
U	1179	1077	22.7	20.7	+ 10%
Sr	911	758	17.5	14.6	+ 20%
Gross (Pu, Th, Am, Cm)	606	236	11.7	4.5	+160%
Ra	1	23	-	-	-
Po	0	28	-	-	-
Gross Beta	153	43	2.9	-	+250%
Pa	159	8	2.9	-	+1900%
H^3	21	7	0.4	-	+200%
Pb	278	265	5.3	-	+ 5%

Average number of samples per week	76.2
Deviation of 1957 weekly average from 1956	+24.6%
Total samples handled 1957	3961

c. Bio-Assay Dose Data

Type of Analysis	Highest Concentration	No. of Individuals whose dose from internal source >250 mrem
Pu	23.1 d/m/24 hr (fecal)	0
U	171	1
Sr	2680	1
Th	2287	6
Pa	6×10^5 d/m/24 hr. specimen	2

2. Calibrations Unit

a. Portable Instrument Inventory

Type	Acquired	Returned	Reserve	Replaced	Assignments New	Assignments Total
Cutie Pie	51	7	32	6	13	245
Juno	0	0	16	0	0	31
Samsons	15	0	1	0	14	32
GMSM	22	0	46	1	5	135
Fiber Dose.	75	51	20	21	20	291
P.S.A.	0	0	6 (No Head)	0	0	20
Misc.	1	18	-	-	-	48

b. Portable Instrument Service and Calibration

Type	>8	6-8	4-5	1-3	0	Total Calibrations
Cutie Pie	11	54	175	5	0	1425
Juno	0	4	20	5	2	122
Samson	2	2	8	18	2	126
GMSM	0	27	108	0	0	782
Fiber Dose•	0	132	32	81	46	1100
P.S.A.	1	2	3	12	2	35
Misc.	0	0	32	12	4	190

c. Miscellaneous Instrument Calibrations

	Total Calibrations
Films	4800
Monitrons	690
Medical Survey	930
Minometer	170
Miscellaneous	73

SECTION III. PERSONNEL MONITORING

Part A. Statistical Data

1. Personnel Meters

a. Distribution and Performance of Pocket Meters

	1957	1957 Weekly Average	Deviation from 1956 Wkly. Av.
Meters Distributed	193,160	3715	01.0%
Readable Meters	193,065	3713	01.0%
Non-Readable Meters	115	2	0
Non-Readable Pairs	0	0	0
Off-Scale Readings	884	17	21.4%
Off-Scale Pairs	136	2.62	109.6%

b. Distribution and Processing Data of Film Meters

West Portal	17,114	329	- 79.4%
East Portal	7,701	148	- 71.3%
Visitors	28,084	540	- 28.4%
Rings, Packets, etc.	5,190	100	- 11.5%
Routine Neutron Films	27,644	532	159.5%
Special Neutron Films	1,853	36	1700.0%
Calibrations	2,302	44	- 66.9%
Correspondents	4,802	92	02.2%
Total Films Handled	94,690	1821	-46.6%

c. Badge Meters Not Serviced — 80

d. Films Lost — 2

2. General Statistics from Film Meter Records

a. Non-Routine Processes (processes other thar regular quarterly change).

Processes by special request	136
Miscellaneous processes(name change, security change, etc.)	103
Film damaged beyond reading	11
Readings lost due to 100% light, X-ray, etc.	7
Films processes when pocket meter total $\gtrsim$ 1500 mr	38
Films processed due to off-scale pocket meters	136

b. Processes in Regular Quarterly Change

Readings unavailable due to light, X-ray contamination, etc.	69
Film readings obtained but inaccurate due to light, X-ray, contamination, fog, etc.	266

c. 1957 Individual Employee Totals $\geqslant$ 5000 mr (D_p)

SECTION IV. RADIATION SURVEY

Part A: Salient and Non-Routine Items

Twenty-seven fellowship students were assigned to the various Radiation Survey Sections for field training during June, July, and August.

Two members of the Radiation Survey Section participated in the operation at the Nevada Test Site during the latter part of the year.

General Research, Chemistry, and Isotope Surveys

On January 21, 1957 two employees became contaminated while removing a pump from W-10 waste tank in the tank farm. One of the employees was decontaminated to background in Building 3505. The other employee was sent to Medical where he was decontaminated to 52 c/m beta. A later check found the count to be down to background. Ref: "Contamination Incident at W-10 Tank", dated January 21, 1957.

Two employees became contaminated on February 11, 1957 while working in Room 127, Building 4501. They were decontaminated to .75 mrem/hr before leaving the plant. They were checked again early the next morning and found to be down to background. On February 12, 1957 one of these employees became contaminated again. A radiation surveyor assisted in the decontamination of this employee. Ref: "Contamination of Personnel in Building 4501", dated February 20, 1957.

A small area behind the barricade in Building 3038 was contaminated on June 13, 1957. A solution containing radioactive material was spilled while being transferred from the product carrier to the barricade. The area was cleaned immediately. Ref: "Iodine-131 Spill in Building 3038", dated June 20, 1957.

On June 13, 1957 one employee became contaminated while preparing the barricade behind the loading window in Building 3038 to be sandblasted. The employee was decontaminated to 5 mrem/hr and sent to the Medical Division where he was decontaminated to background. Ref: "Contamination of Employee in Building 3038", dated June 21, 1957.

On June 25, 1957 two employees were contaminated while working in Cell 4 in Semi-Works, Building 3550. After these employees had reduced the contamination on their hands to 500 c/m alpha, they were sent to the Medical Division where they were decontaminated to background. Ref: "Alpha Contamination of Maintenance Men in Semi-Works, Building 3550", dated July 3, 1957.

On July 8, 1957 one employee who had been working in Building 3030 found his right wrist contaminated. After decontaminating the spot to 50 mrem/hr, he was sent to the Medical Division where he was decontaminated to 1834 c/m beta. He was later decontaminated down to background. Ref: "Contamination of Employee in Isotope Area", dated July 10, 1957.

On July 10, 1957 the entire first level of Building 4501 was found to be contaminated. All personnel who had been in the contaminated area were found to have contaminated shoes. The shoes were immediately decontaminated. After 2-1/2 days of cleaning, most areas were down to background. A few days later the entire area was cleaned to background. Ref: "Contamination of Building 4501", dated July 19, 1957.

Reactor and Pilot Plant Surveys

Through most of the year, the Thorex Pilot Plant in Building 3019 continued processing of short-cooled thorium slugs. On August 15, 1957 the processing of short cooled slugs was started. The operation was shut down on November 4 following significant exposures to a limited number of personnel. Details of these incidents are contained in the following correspondence: (1) Subject: "Exposure to Employee" from K. Z. Morgan to R. A. Charpie dated October 14, 1957. (2) Subject: "Exposure to Employee" from K. Z. Morgan to R. A. Charpie dated November 12, 1957.

During the latter part of the year a rather serious radioactive fallout problem developed from the Thorex operation. This problem was discussed in a report from H. H. Abee to J. C. Hart dated November 18, 1957.

The Volatility Pilot Plant, Building 3019, was started up during the latter half of the year. Two runs of a possible eight run schedule on ARE fuel were made during December. Incidents of airborne alpha activity and surface contamination resulting from these runs are idscussed in a report from D. E. Arthur to A. D. Warden dated January 17, 1958.

The High Radiation Level Analtyical Facility went into operation during this period. Thorex Process Control samples were handled here with activities ranging up to 6000 r/hr at 2" from unshielded 10 ml samples.

The Metal Recovery Program in Building 3505 reclaiming uranium, neptunium, plutonium, and americium has proceeded with a minimum of incidents. A new vessel off-gas and cell ventilation system was installed, tying this facility into the Isotope Area stack.

There were three incidents of airborne radioactive contamination resulting from experimental equipment in the LITR (Building 3005) during this period. There occurred:

June 18, 1957. In preparation for removal of a rocking bomb experiment from HB-6 the bomb was off-gased into the west room. The gaseous activity gave Cutie Pie (paper chamber) readings up to 800 mr/hr and the building was evacuated for three hours. Activity (of lower level) in Buildings 3004 and 3010.

August 28, 1957. Again the activity arose from removal of the same type of experiment from the same beam hole. The building was evacuated for 2-1/4 hours on this date.

November 12, 1957. Fission gases were released from an HB-5 experiment into the east room, making it necessary to evacuate the building for short times once in the morning and again in the afternoon.

On December 4, 1957 a thorium-228 source was removed from its aluminum container using the remote equipment in Cell 1, Building 3025. A survey the next day showed the cell to be grossly alpha contaminated. Decontamination work is still being done.